Oxygen Abundances for a Large Sample of Carbon-Enhanced Metal-Poor Stars

JINA researchers have observed a large sample of over 55 Carbon-Enhanced Metal-Poor Stars using the OSIRIS near-infrared spectrograph on the SOAR 4.1 m telescope in Chile. These observations are used for the estimation of oxygen abundances, [O/Fe].

Oxygen abundances are notoriously difficult to obtain from optical spectra, due to the weakness of the oxygen line at a wavelength of 6300 Å. However, [O/Fe] estimates obtained from the prominent molecular CO features in the near-IR spectra allow for practical, time-saving abundance analysis which eliminates the need for long observations on large-scale telescopes. Each star observed with OSIRIS has a previously-estimated value of effective temperature, surface gravity, metallicity, and carbon abundance. With these known values, the oxygen abundance is readily calculated by fitting four CO features with model spectra. An example of this fitting is shown in the figure in the upper right of the page.

While it is difficult to obtain estimates of oxygen from optical spectra, researchers have obtained estimates using high-resolution spectra for some Carbon-Enhanced Metal-Poor stars. With this information, JINA scientists are able to compare the oxygen abundances from the OSIRIS observations to previously-determined [O/Fe] values for different classes of Carbon-Enhanced Metal-Poor stars. Such a comparison is shown in the bottom-right figure. The [O/Fe] estimates are compared to those estimated for carbon-normal metal-poor stars ([C/Fe] < +0.5), CEMP-s (those with s-process element enhancement), CEMP-rs (those with both r- and s-process element enhancement), and CEMP-no (those with no neutron-capture element enhancement). The majority of the stars in the sample are consistent with CEMP-s stars, which are the most commonly-observed type to date.

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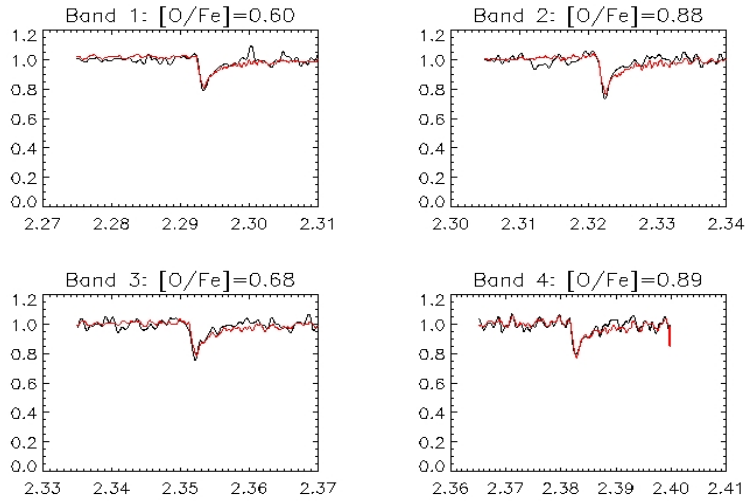
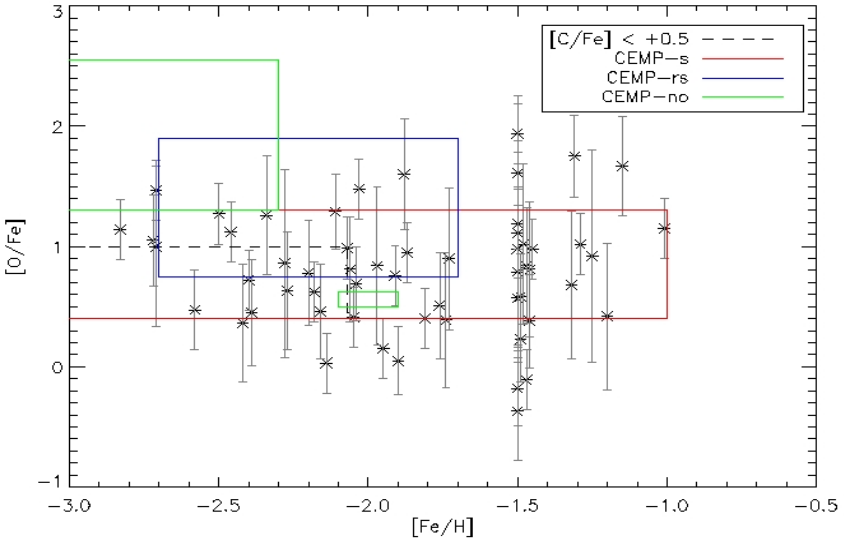


Example of the [O/Fe] estimation technique for one star. Each panel is a CO feature from the near-IR spectrum. The black line is the data and the red line is the best-fitting model spectrum.



[O/Fe] vs. [Fe/H] for the entire sample (black stars). The different-colored boxes enclose the regions occupied by the different types of CEMP stars based on high-resolution [O/Fe] abundances of CEMP stars.

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